



REPORT OF SURVEY CONDUCTED AT

**SAE INTERNATIONAL AND
PERFORMANCE REVIEW INSTITUTE
WARRENDALE, PA**

FEBRUARY 1997

Best Manufacturing Practices



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Foreword



This report was produced by the Best Manufacturing Practices (BMP) program, a unique industry and government cooperative technology transfer effort that improves the competitiveness of America's industrial base both here and abroad. Our main goal at BMP is to increase the quality, reliability, and maintainability of goods produced by American firms. The primary objective toward this goal is simple: to identify best practices, document them, and then encourage industry and government to share information about them.

The BMP program set out in 1985 to help businesses by identifying, researching, and promoting exceptional manufacturing practices, methods, and procedures in design, test, production, facilities, logistics, and management – all areas which are highlighted in the Department of Defense's 4245-7.M, *Transition from Development to Production* manual. By fostering the sharing of information across industry lines, BMP has become a resource in helping companies identify their weak areas and examine how other companies have improved similar situations. This sharing of ideas allows companies to learn from others' attempts and to avoid costly and time-consuming duplication.

BMP identifies and documents best practices by conducting in-depth, voluntary surveys such as this one at the Society of Automotive Engineers International and its affiliate, Performance Review Institute, Warrendale, Pennsylvania conducted during the week of February 3, 1997. Teams of BMP experts work hand-in-hand on-site with the company to examine existing practices, uncover best practices, and identify areas for even better practices.

The final survey report, which details the findings, is distributed electronically and in hard copy to thousands of representatives from government, industry, and academia throughout the U.S. and Canada – *so the knowledge can be shared*. BMP also distributes this information through several interactive services which include CD-ROMs, BMPnet, and a World Wide Web Home Page located on the Internet at <http://www.bmpcoe.org>. The actual exchange of detailed data is between companies at their discretion.

Most organizations that have been in existence for more than 90 years are generally considered stable and respectable. However, longevity is not the only measure for success. The Society of Automotive Engineers' 92 years have been adorned with achievements almost too numerous to mention and that parade of attainments has extended unbroken to the present. As a dynamic organization, the Society responds rapidly to change and provides information on cutting-edge technology. Among the best examples were the Society of Automotive Engineers' accomplishments in aerospace standards; Cooperative Research Program; Performance Review Institute; National Aerospace and Defense Contractors Accreditation Program; and engineering tools.

The Best Manufacturing Practices program is committed to strengthening the U.S. industrial base. Survey findings in reports such as this one on the Society of Automotive Engineers expand BMP's contribution toward its goal of a stronger, more competitive, globally-minded, and environmentally-conscious American industrial program.

I encourage your participation and use of this unique resource.

A handwritten signature in cursive script, reading 'Ernie Renner'.

Ernie Renner

Director, Best Manufacturing Practices

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Section 1

Report Summary

Background

The Society of Automotive Engineers (SAE) International functions as the major source of technical information and expertise for the design, manufacture, operation, maintenance, and recycling of self-propelled vehicles (land, sea, air, and space) around the world. Its 72,000 membership represents a network of engineers, business executives, educators, and students from more than 80 countries who come together to share information and exchange ideas for advancing the engineering of mobility systems. Originally founded as the Society of Automobile Engineers in 1905, SAE changed to its present name in 1917. SAE is located in Warrendale, Pennsylvania and employs 400 personnel.

From the beginning, SAE was known for its standards. Most notably is its first standard in 1906 (spring engineering techniques) and its first aerospace standard in 1917 (interchangeable spark plugs). However, engine oil viscosity remains SAE's most famous standard. First issued in 1911, an updated version of that standard is still in use. Besides standards, the Society sponsors conferences and professional education around the world; publishes and distributes hundreds of books, publications, and papers on mobility-related technical material; hosts nationwide student design competitions annually; participates in public awareness programs on passenger safety and energy resource conservation; and promotes globalization as one of its strategic initiatives.

SAE is a reservoir for knowledge and new thinking in the mobility industry. Whether these ideas emerge from a conference presentation, a student design competition, a professional publication, or a causal conversation, SAE provides the springboard from which colleagues can launch innovations to propel the mobility industry into the future. Among the best examples were SAE's aerospace standards; Cooperative Research Program; Performance Review Institute; National Aerospace and Defense Contractors Accreditation Program; and engineering tools.

SAE operates the world's largest non-government aerospace standards program. The Society maintains an active liaison with national and international standards organizations to fully coordi-

nate and harmonize its standards as well as to avoid duplication. SAE has published more than 4,500 aerospace standards and specifications which are used worldwide for the design and production of aircraft components and systems.

The Cooperative Research Program provides the means for industry, government, and academia to cooperate in shared research efforts. As an independent, unbiased, non-profit organization, SAE is recognized by its peers for having excellent credibility and offers a proven framework for coordinating and facilitating group activities; providing administrative support; developing and monitoring third-party contracts; maintaining financial records; and guiding successful completion of projects.

The Performance Review Institute's overall mission is to lead the mobility industry by effectively using accreditation and certification programs based on industry consensus standards that improve total product quality, reduce total cost, and enhance global competitiveness. These goals are accomplished through its two core programs: the National Aerospace and Defense Contractors Accreditation Program and the International Standards Organization Registrar.

As an aerospace and DoD supplier accreditation program, the National Aerospace and Defense Contractors Accreditation Program's purpose is to reduce and streamline the large number of redundant quality systems' audits being conducted on supplier organizations. The program represents a unique arrangement among original equipment manufacturers, prime contractors, and users which combines second-party and third-party approaches with the accreditation of suppliers, in accordance with consensus-derived requirements.

By developing engineering tools, SAE has filled a niche in technology not met by industry, government, or academia. Classified under referee materials and engineering aids, SAE's tools facilitate the implementation and use of standards by providing baseline materials for product comparison and devices for verifying test results and standards. The most successful tool is the Three-Dimensional H-Point Engineering Aid Support which meets national and international standards for describing seated occupant location in vehicles.

Most organizations that have been in existence for more than 90 years are generally considered stable and respectable. However, longevity is not the only measure for success. SAE's 92 years have been adorned with achievements almost too numerous to mention and that parade of attainments has extended unbroken to the present. As a dynamic organization, SAE responds rapidly to change and provides information on cutting-edge technology. The BMP survey team considers the following practices to be among the best in industry and government.

Best Practices

The following best practices were documented at SAE:

Item	Page
Aerospace Standards	5
Because of its name, many people do not realize that SAE operates the world's largest non-government aerospace standards program. SAE has published more than 4,500 aerospace standards and specifications which are used worldwide for the design and production of aircraft components and systems. The aerospace program's focus includes maintenance and operation issues; aircraft design; manufacturing; deicing; paint stripping; and MIL SPEC conversion.	
Cooperative Research Program Overview	6
SAE's Cooperative Research Program provides the means for industry, government, and academia to cooperate in shared research efforts. Services provided by the program include coordinating and facilitating group activities; providing administrative support; developing and monitoring third party contracts; maintaining financial records; and guiding successful completion of projects.	
Cooperative Research Program Process	7
Through the Cooperative Research Program, SAE has established comprehensive, but flexible, processes for accommodating various mobility research projects. The highlighted processes of the program include project selection, participant selection, funding, contract management, and project management.	

Item	Page
Marketing for Standards Development	8
SAE has added a marketing function within its Standards Development and Research Division as a proactive strategy. Objectives of the marketing plan include meeting users' needs in industry and government; increasing internal and external involvement with the standards process; and developing business opportunities and products for the division.	
National Aerospace and Defense Contractors Accreditation Program	9
As an aerospace and DoD supplier accreditation program, the National Aerospace and Defense Contractors Accreditation Program's purpose is to reduce and streamline the large number of redundant quality systems audits being conducted on supplier organizations. To assure an unbiased and objective organizational structure, the program was spun-off to the newly-formed affiliate, Performance Review Institute, in May 1990.	
Performance Review Institute	10
The Performance Review Institute's overall mission is to lead the U.S. mobility industry by effectively using accreditation and certification programs based on industry consensus standards that improve total product quality, reduce total cost, and enhance global competitiveness. As an affiliate of SAE, the Institute's specific focus is to advance the interests of the automotive industries and to administer quality assurance accreditation and certification programs. Among others, Performance Review Institute is accredited to certify suppliers to the National Aerospace and Defense Contractors Accreditation Program, ISO-9000, QS-9000, AS-9000, and the Fastener Quality Act.	
Product Delivery through Electronic Media	11
Realizing that users require different formats for data, SAE has adapted to the changing information distribution environment by using electronic media methods in addition to conventional means. Besides using CD-ROMs and on-line relational database systems, SAE has been actively developing Internet applications and distribution possibilities.	

Item	Page
Publications	11
SAE publishes and distributes hundreds of books, publications, and papers. Each year more than 20,000 pages of new mobility related technical material is added. Topics include high-strength steels, computer-aided design, artificial intelligence, aerodynamics, intelligent highway systems, biomechanics, and space operations simulation.	

Standards Development	12
The Technical Standards Board oversees the overall responsibilities of the standards development operations through the various administrative committees, councils, divisions, and technical committees. This Board is the only group within SAE authorized to develop standards and take responsibility for any requirements associated with consensus activities.	

Technical Information Management System	13
A decision was made to change the collection, production, and distribution of SAE's technical information from a paper distribution system to a computerized database system driven by engineers' needs for quick, on-demand information. With this goal in mind, SAE's core competencies will be maintained through the Technical Information Management System.	

Information

The following information items were documented at SAE:

Item	Page
Engineering Tools	15
SAE's Standards Development and Research Division has taken a proactive approach to meet its vision of advancing the mobility community and producing a revenue stream for the Technical Standards Board. To facilitate the implementation and use of standards throughout industry, SAE has developed engineering tools to fill a niche in technology not met by industry, government, or academia.	

International Role in Mobility Engineering	15
After making the decision to become international in its scope and role, SAE established its	

Item	Page
first affiliate in 1991. SAE's membership is now available throughout the world with a focus on Great Britain, Germany, Russia, China, Brazil, India, Japan, Ukraine, Romania, and Korea.	

Cooperative Research Program Marketing	16
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In the past, outreach activities to identify markets for SAE services were limited to announcements, newsletters, and advertisements. SAE is now developing a proactive marketing effort to promote and sell its Cooperative Research Program and administrative services.

Performance Review Board	16
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As an integral part of the SAE corporate structure, the Performance Review Board is responsible for the majority of the Department of Defense's (Army) component interests. The Board tests product samples and determines each sample's compliance level to the appropriate standards and specifications.

Revenue	17
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SAE operates as a not-for-profit corporation that is tax exempt under Section 501(c)(3) of the Internal Revenue Code. As a technical society, SAE focuses on developing, collecting, and disseminating mobility technology knowledge on a worldwide basis and advancing these fields and their practitioners in a manner which serves humanity.

Problem Area

The following problem area was documented at SAE:

Item	Page
MIL SPEC Conversion to Commercial Standards	19

With the Perry initiative, many military specifications are being canceled or converted to commercial standards. Problems arising from this situation include low support from industry and government; lack of sufficient funding for conversion processes; no easy means of cross-referencing between commercial and military specifications; and incorrect identification of replacement specifications that do not meet industry standards.

Point Of Contact

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Section 2

Best Practices

Management

Aerospace Standards

Because of its name, many people do not realize that the Society of Automotive Engineers (SAE) operates the world's largest non-government aerospace standards program. This user-managed, user-oriented program is international in scope and focuses on procurement. SAE published its first aeronautic standard (interchangeable spark plugs) in 1917. Early aviation pioneers such as Elmer Sperry, Orville Wright, Glenn Curtis, and Glenn Martin helped to merge the American Society of Aeronautical Engineers into SAE and establish the Society's leadership role in aerospace. Today, SAE has published more than 4,500 aerospace standards and specifications which are used worldwide for the design and production of aircraft components and systems. Drafted by industry experts, these SAE standards and specifications are used on a voluntary basis by industry and government.

Under the Technical Standards Board, the Aerospace Council governs SAE's aerospace operations. The council members represent executives from commercial, regional, general aviation, military, space, and government agencies. Their responsibility is to ensure the aerospace standards program is well managed, progresses in a timely and cost-effective manner, meets user needs, and avoids duplication of effort. Figure 2-1 shows the organizational relationship of the Aerospace Council. In 1994, SAE's Board of Directors established the Aerospace Program Office (APO) with executives from the aerospace industry. APO identified various technical issues for focus within SAE: anti-icing and de-icing; paint and paint removal; reliability analysis; cabin automation; safety; fasteners; man-machine interface; and training.

In 1995, SAE produced 213 new and revised aerospace standards and continued to lead the industry in electronic development and dissemination of standards. In addition, SAE published commercial versions of MIL-STD-1553 and MIL-STD-1773 data

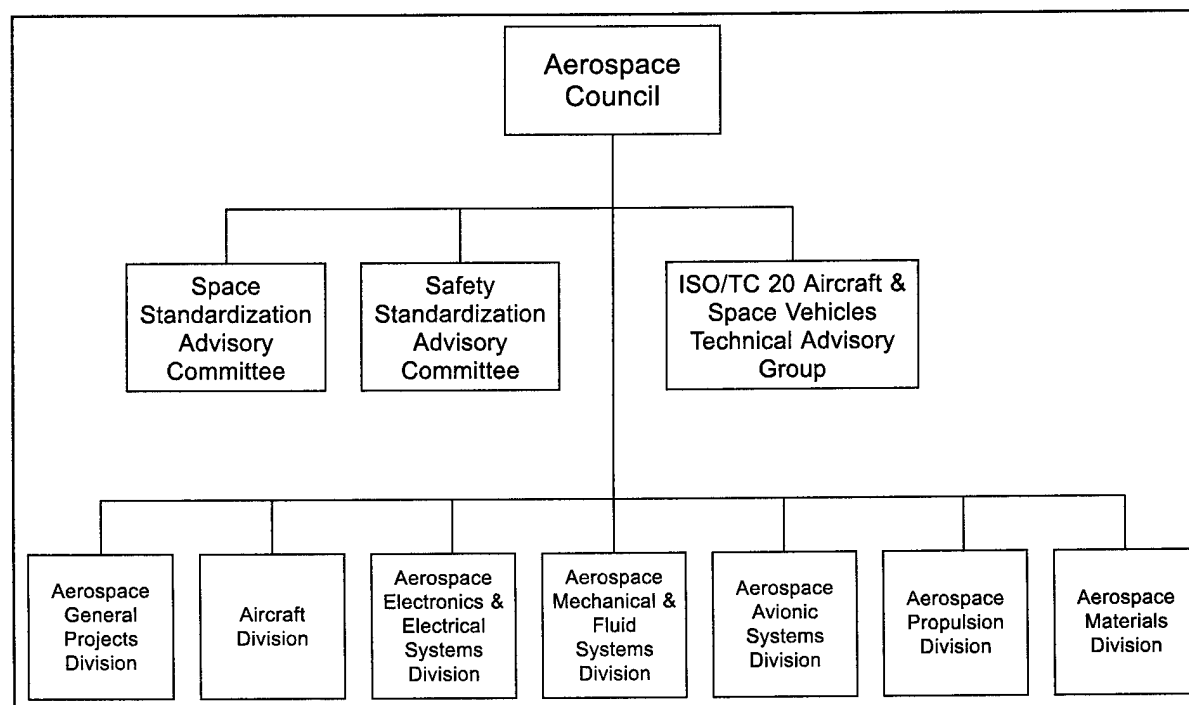


Figure 2-1. Aerospace Council Organization

bus standards and established a project to develop an industry and government prioritized list of standards and specifications for potential conversion to SAE documents. Aerospace standards are accredited by the American National Standards Institute. SAE submits its aerospace standards for adoption as American National Standards. SAE maintains an active liaison with national and international standards organizations to fully coordinate and harmonize its standards as well as to avoid duplication. SAE is the administrator of the U.S. Technical Advisory Group to the International Standards Organization (ISO) committee for aircraft and space vehicles. Many SAE air and space committees interface with ISO and provide the majority of the U.S. delegates for ISO's counterpart committees. These activities stimulate communication among international technical experts and provide a valuable service to the international aerospace community.

In 1996, SAE's aerospace standards program had more than 7,100 participants on 272 committees which represented 930 companies and organizations. The development process for aerospace standards and technical information (Figure 2-2) is very similar to the process for ground vehicles. As a very dynamic area, aerospace standards are influenced by many factors such as industry consolidation, MIL SPEC conversions, regulatory agencies, computerization, and rapid changes.

Cooperative Research Program Overview

SAE's Cooperative Research Program (CRP) provides the means for industry, government, and academia to cooperate in shared research efforts. Services provided by CRP include coordinating and facilitating group activities; providing administrative support; developing and monitoring third party contracts; maintaining financial records; and guiding successful completion of projects.

In today's economic climate, worldwide industrial competition rises at a rapid pace. The mobility

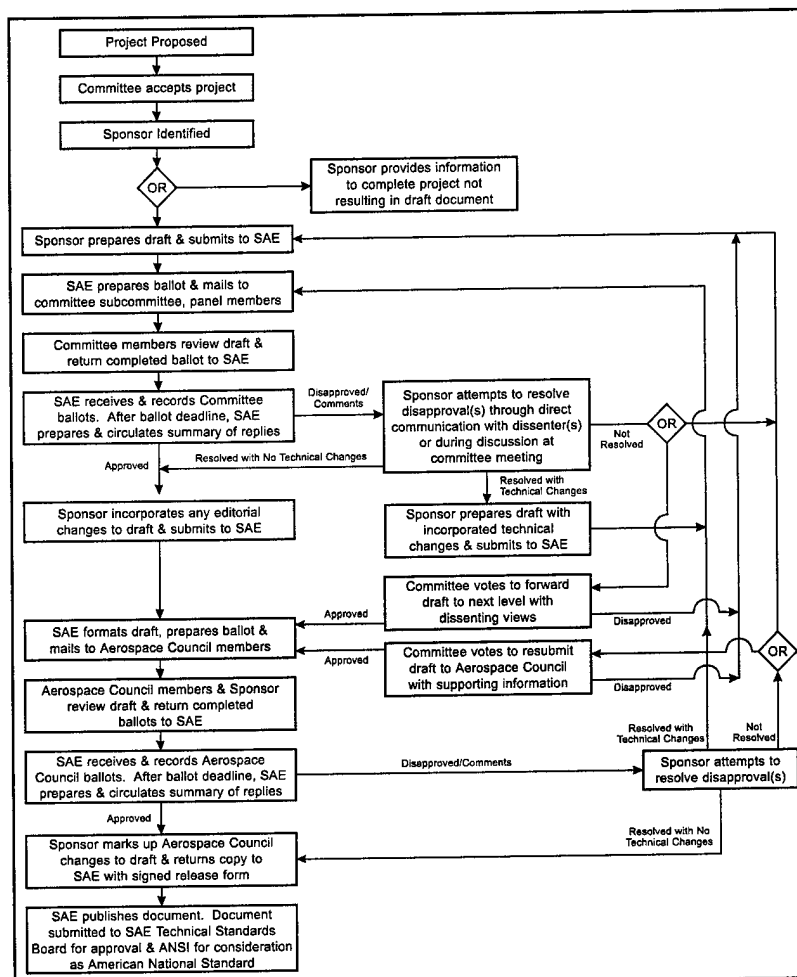


Figure 2-2. Aerospace Document Process

industry must continuously improve quality, decrease cost, and be innovative. Companies can no longer afford or guarantee a successful outcome from independent research. Cooperative research allows companies to join forces; share costs and expertise; and avoid duplication. In 1984, the National Cooperative Research Act greatly relaxed anti-trust restraints, allowing companies within an industry to conduct cooperative research without the threat of anti-trust actions. SAE's basic charter fosters cooperative efforts to serve industry.

As an independent, unbiased, non-profit organization, SAE is recognized by its peers for having excellent credibility. SAE offers a proven framework for administering cooperative research and provides experience in the management and facilitation of projects. Services include bringing together prospective research partners to plan projects; furnishing facilities and staff for meetings; providing project management and coordina-

tion; working with government agencies for possibly acquiring funding; adhering to contractual requirements; ensuring conformance to the National Cooperative Research Act; providing a legal forum for solving legal issues; and setting up an accounting system specific for each cooperative project. SAE can also locate subcontractors if needed; administer budgets and contracts; set up and maintain the escrow accounts for the cooperative research participants; and provide publications capability for releasing the research results.

SAE determines the participation criteria based on technical background, financial contributions, and resources needed for each project. Entrance for interested parties is through SAE's CRP Staff. The Research Executive Committee then reviews and approves all projects. Structured for autonomous operation, CRP administers the project while the research participants direct it. Funding comes from participants' financial and resource contributions (e.g., personnel, equipment, facilities, data) and from grants or contracts by federal, state, and local government agencies. Costs may be defrayed by the sale of published results or a final report. In all cases, SAE seeks to recover direct costs for providing administrative services with the goal of breaking even or better.

CRP, started in 1990, has administered 45 Cooperative Research Projects with 19 completed and the rest being in an active or developmental status. The automotive and truck industry accounts for 75% of the projects. From initiation to completion, projects average about 1.5 years. Size and cost depend on the urgency, complexity, and composition of the project, ranging from the smallest at \$5 thousand to the largest at \$2 million. Completed projects include HFC-134a Refrigerant for Air Conditioning; High-speed Multiplexing Data Links; Natural Gas Vehicles Research; and Air Bag End Use and Management. Active projects include the Civilian American & European Surface Anthropometry Resource (CAESAR) project; Distributive Lighting; Misfueling Lockout; Sound Level Urban Driving Cycle; Airbag Skin Burn Modeling; and Electrical Vehicle Battery Recharging. Projects under development or still looking for participants include CAESAR; Marine Fuel Hose Study; Aerospace Connection Locking Device; Diesel Engine Combustion Research; Crash Avoidance Sensors; Adaptive Devices; and Oxygenated Fuels Research.

SAE's CRP continues to grow and prove its success. Members and industry participants accomplish leading-edge research at a fraction of the cost for independent research. Participants benefit from

the interaction with peers; the ability to influence and develop the research's scope; the confidentiality that SAE brings as a third party; and the efficiency of SAE's management and administrative framework.

Cooperative Research Program Process

SAE's CRP provides the means for industry, government, and academia to cooperate in shared research efforts. SAE has established comprehensive, but flexible, processes for accommodating various mobility research projects. The processes described below highlight the significant steps of the CRP process such as project selection, participant selection, funding, contract management, and project management.

CRP's project selection begins in many ways. Companies may identify projects and request SAE to facilitate a joint venture. SAE's Technical Committees may identify research needed to support reports, standards, practices, and specifications. Any group of companies or participants (members or non-members) may also identify a project for SAE to facilitate. The Research Executive Committee reviews and approves all projects for appropriateness to the SAE charter and conformance with the National Cooperative Research Act. In general, projects must advance the technical expertise used to design, build, maintain, and operate self-propelled (land, sea, air, and space) vehicles.

After research projects are identified and approved, research participant selection begins. Participation criteria generally are based on technical background, financial contributions, and resources needed for the project. As the administrator, SAE provides an unbiased and legal environment for the project and participants; prevents any participating organization or industry segment from dominating the project's direction and outcome; and ensures adherence to the National Cooperative Research Act. Participants can be identified and/or targeted based on their technical interest via SAE's extensive customer database. In addition, participation can be solicited or encouraged through SAE's outreach activities such as periodicals, newsletters, and newspapers. When appropriate, SAE can enlist or give the opportunity to an entire industry to participate in projects. Some projects have included more than 20 organizations and government agencies.

Funding comes from participants' financial and resource contributions (e.g., personnel, equipment, facilities, data) and from grants or contracts by

federal, state, and local government agencies. Funding options are open, flexible, and accommodate equal status to all participants in the project. Participants grant final decisions for all funding options. In all cases, SAE seeks to recover direct costs for providing administrative services with the goal of breaking even or better. Before any project commences, funding commitments must be secured. SAE has the framework to set up distinct project escrow accounts for the participants; solicit contributions; invoice per contract; and disburse to subcontractors. SAE's accounting services are provided free of charge to the CRP project, and were developed to accommodate government guidelines and satisfy government audits.

Through contract management, SAE administers the CRP projects by issuing contracts or other agreements with any third party involved in the project. The Society maintains legal expertise and experience in government contract requirements and adherence. SAE's ability to act as contract signatory proves to be very significant with respect to fiscal year liability. In addition, SAE can set up proprietary partnerships and restrict distribution of results as identified by the participants. For projects requiring confidentiality, SAE can code the data, resources, and results. The Society maintains an extensive publication framework for disseminating results to the project partners and the public.

CRP is structured for autonomous operation and project flexibility. Through project management, the participants direct the CRP project by forming a management group. SAE then carries out the administrative responsibilities, drawing on its expertise in resolving project issues and its lessons learned in diverting unique issues. Additional services provided by SAE include graphic and publishing capabilities for the project's research results and final reports; distribution to appropriate participants, members, industrial interest groups, and the public; and inclusion in and archival maintenance to appropriate databases.

In addition, CRP promotes strong ties to SAE's Technical Standards Program. Approximately 50% of the projects are in some way associated with an SAE technical standards committee or technical area. As a result of CRP projects, SAE has developed dozens of new standards and provided data limits for many more. Many government projects call for a draft standard as a deliverable from the research project.

Marketing for Standards Development

In the past year, SAE added a marketing function within its Standards Development and Research Division. This capability represents a fundamental change in the approach and focus of the division. Previously, the division developed and updated standards in response to requirements. Now, SAE uses marketing as a proactive strategy for meeting customers' needs and enhancing SAE's business growth. Marketing is viewed not just as a promotion tool, but also as an active participant in all phases of standards development, from concept through application by the end user. SAE's marketing plan objectives include meeting users' needs in industry and government; increasing internal and external involvement with the standards process; and developing business opportunities and products for the division.

SAE wants to ensure that companies are fully participating in and supporting the development process, in addition to understanding the value of the SAE products and services received. Quantitative measurements used to track performance include the number of standards and papers published; the number of standards harmonized with international standards; and the number of international committee members. SAE uses marketing tools to target specific growth opportunities. These include new and emerging technologies for current markets and new markets in areas such as next generation vehicles, cooperative research, intelligent transport systems, and conformity assessment.

SAE targets two levels of customers through its marketing approach. The primary target aims at upper management personnel of those companies that use SAE standards. The secondary target focuses on technical personnel who apply SAE standards in the work place. Through extensive market research, SAE ensures that customers' needs are being met which results in satisfied and loyal advocates. From its marketing research studies, SAE determined it needed to interface more effectively with top management; become more proactive in international standards development; focus on the development of relevant standards supported by underlying business rationale; and elevate the overall perception and value of standards. To address these needs, marketing is now creating a new image for the Standards Development and Research Division which crosses all markets, addresses different levels of management,

and defines SAE as a global leader and catalyst in standards development. SAE selected the gyroscope to symbolize its new image as a dynamic representation of first-class quality and leadership. The symbol will be featured prominently on divisional marketing materials.

The marketing plan also calls for effective use of communication and promotional tools. SAE has designed promotional tools for specific targets and purposes such as showing the benefits of corporate participation, increasing technical participation, and reaching out to all target populations. In addition, an interactive CD-ROM, multi-media presentation is being released to champion the benefits of corporate participation, underscoring the profit-driven value of standardization. The division's newsletter has been upgraded and strongly promoted as an important communication tool. SAE has been communicating its marketing message by using a varied media mix of publications, conferences, meetings, workshops, and forums.

In its brief existence, SAE's marketing thrust has greatly increased awareness of its standards development capabilities. Increased communication is leading to new partnerships, both internal and external to SAE, such as national and international companies, government agencies, and other standards organizations. Metrics have been put in place to ascertain advertising and promotional effectiveness. Marketing research is helping various standards committees improve their capabilities and take advantage of new business development opportunities. Marketing will continue to play a key role in maintaining SAE's leadership position in a rapidly-developing global marketplace for standards.

National Aerospace and Defense Contractors Accreditation Program

As an aerospace and DoD supplier accreditation program, the National Aerospace and Defense Contractors Accreditation Program's (NADCAP's) purpose is to reduce and streamline the large number of redundant quality systems' audits being conducted on supplier organizations. SAE's Aerospace Council approved the formation of the first NADCAP Accreditation Task Group in May 1987 which led to the first NADCAP meeting in September 1987. Government and industry funding for NADCAP's development and pilot auditing was secured between 1988 and 1989. To assure an unbiased and objective organizational structure, NADCAP was

spun-off to the newly-formed affiliate, Performance Review Institute, in May 1990.

NADCAP represents a unique arrangement among original equipment manufacturers, prime contractors, and users which combines second-party and third-party approaches with the accreditation of suppliers, in accordance with consensus-derived requirements. The overall program is guided by the NADCAP Council as well as the individual, product-class task groups (users of the accreditation process). A qualified manufacturers list identifies accredited suppliers that are available to subscribers.

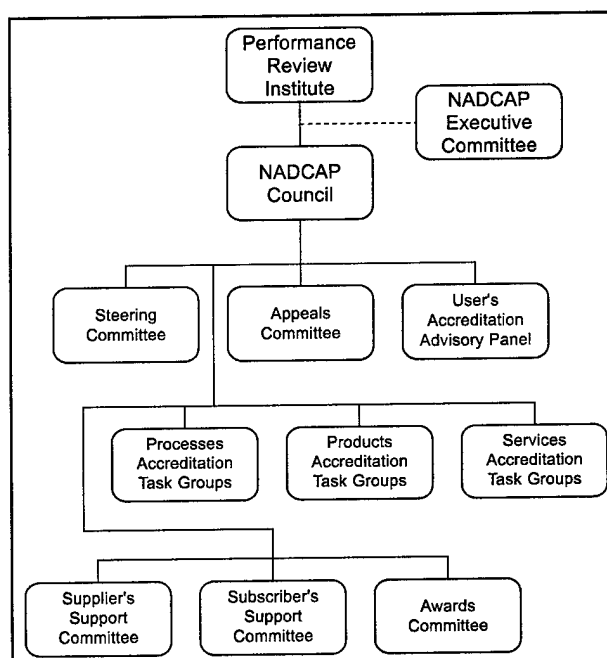


Figure 2-3. NADCAP Organization

NADCAP relies heavily on industry element participation and guidance. Figure 2-3 shows the structure of NADCAP. NADCAP membership categories consist of:

- **Subscriber** — A NADCAP user with a vote in all NADCAP activities; a prime contractor in this category can subscribe to individual NADCAP programs and implement NADCAP in accordance with its own established procedures.
- **Government** — Representatives of government agencies with a vote in all NADCAP activities.
- **Associate Prime** — A NADCAP user member who can participate in NADCAP meetings, but has no formal vote at these meetings.

- **Supplier** — An active supplier who has a vote in task groups on non-accreditation matters and can participate in the development and revision of audit criteria.
- **Consultant** — An individual with specific technical knowledge for a particular task group.
- **Pending Subscriber** — A temporary subscriber status which allows new users to fully participate, but only has a vote in a task group during its audit criteria development.
- **Observer** — Can attend NADCAP meetings.

NADCAP task groups are responsible for the development of specific requirements and associated audit checklists for compliance with specifications and standards. Examples of currently-active task groups include chemical processes, general quality systems, welding processes, coatings, heat treat, distributors, materials test laboratory, fasteners, nondestructive test, fluid system components, and sealants.

Currently, NADCAP has 19 major subscribers and five associate primes. The use of NADCAP industry consensus-based certification is actively supported by DoD, NASA, the Defense Logistics Agency, the Federal Aviation Administration (FAA), and the Canadian National Defense. Held regularly at various locations, NADCAP meetings allow participants to devise consensus-based decisions regarding specific audit criteria, auditor qualifications, hiring issues, and supplier accreditation status. The participants use audit results and the thoroughness of corrective action in response to audit findings. Since DoD, NASA, and FAA accept NADCAP-based accreditation as inherent parts of contractor quality systems, it is critical for prime contractors to participate in these meetings.

NADCAP improves supplier quality and reduces the burden on suppliers and subcontractors due to redundant customer oversight. Other benefits include corresponding savings to primes in the downsizing of quality surveillance staff, as well as the establishment and use of non-government standards which represent best industry practices.

Performance Review Institute

The Performance Review Institute (PRI) was formed as an SAE affiliated, but independent organization, in May 1990. PRI's overall mission is to lead the U.S. mobility industry by effectively using accreditation and certification programs based on industry consensus standards that improve total product quality, reduce total cost, and enhance global competitiveness. As an affiliate of SAE, PRI's specific focus is to advance the interests of the automotive industries and to administer quality assurance accreditation and certification programs.

PRI accomplishes its goals through two core programs: NADCAP and the ISO Registrar. The intent of the ISO Registrar is to serve the mobility industry as a recognized world-class, third-party certification function which contributes to global success. The ISO Registrar achieves its goals by offering high-quality, cost-effective, and timely services (e.g., ISO-9000, QS-9000, AS-9000, Fastener Quality Act) and enhancing respect for and competency of the registration process through selection and employment of qualified auditors with mobility industry expertise and volunteers with technical expertise in the decision-making process.

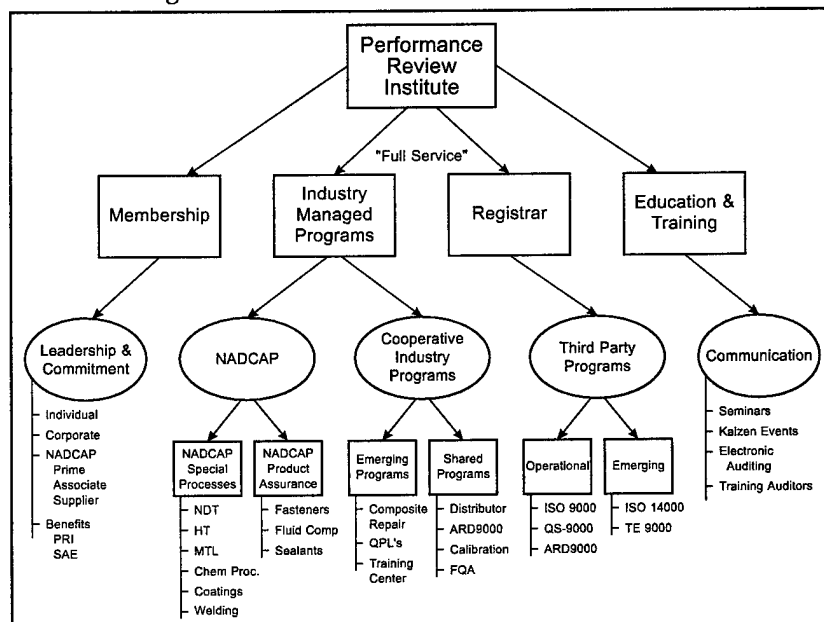


Figure 2-4. PRI Organization

Figure 2-4 shows the overall organizational structure of PRI. PRI's processes involve the scheduling, conducting, and reviewing of audits and the issuing

of certifications and related activities. Process customers are those organizations undergoing the audits. PRI's product is the certification information itself. Product customers include the original equipment manufacturers, prime contractors, suppliers, and government agencies.

Product Delivery through Electronic Media

SAE's core competency has always focused on the distribution of standards, publications, and technical information. Realizing that users require different formats for data, SAE has adapted to the changing information distribution environment by using electronic media methods in addition to conventional means. Besides using CD-ROMs and online relational database systems, SAE has been actively developing Internet applications and distribution possibilities.

A significant portion of the revenue for SAE's Electronic Publishing Division comes from CD-ROM sales. Available for purchase by individuals and companies, SAE standards, technical papers, and other publications can quickly be queried on the latest technical topics. Current databases available on CD-ROM include SAE Publications and Standards; Highway Vehicles Safety Database; SAE Aerospace Technology Database; SAE Automotive Fuels & Lubricants Database; SAE Technical Papers; SAE Handbook; SAE Standards; and the Global Mobility Database (GMD). In addition, free working models are available and can be downloaded from SAE's website (www.sae.org). With the rapid influx of information coming into SAE, the cost of these CD-ROMs includes a one-year subscription to the latest updates.

As a valuable database, GMD maintains SAE's core competency for distributing information on self-propelled vehicles. The foremost source of worldwide vehicle technology information, GMD features the summaries from more than 85,000 publications which date back to 1906. Custom-designed for user-friendliness, SAE's MOVE search software (available for Windows and DOS) guides the user through each step of the investigation and search processes by using simple fill-in-the-blank search forms. GMD can locate critical document information such as comprehensive summaries, author, publication date(s), document number, referenced documents, and other related subject categories. Ideal for technical practitioners or information

specialists, GMD covers essential publications for engineers around the world.

By the end of 1998, SAE anticipates that most of its conventionally-distributed information will be available via the Internet. After examining the latest innovations in electronic commerce, SAE began studying two subscription models: renewable year-by-year accounts and pay-as-you-go accounts. Renewable accounts would allow customers to download documents in .pdf and/or .ascii formats. Pay-as-you-go accounts would charge the customer for the amount of text downloaded or printed. Currently, customers can access automotive information over the Internet through SAE's GMD; Fuels and Lubricants Database; Auto HEADLINE NEWS (via e-mail); and Auto PRODUCT NEWS. SAE anticipates the availability of six new products by the end of 1997.

To facilitate CD-ROM, Internet, and other such efforts, the Electronic Publishing Division handles and promotes the dissemination of SAE products. Separating the electronic version from the hard copy version has proven to be a successful and growing industry for SAE. In-house studies have shown that 80% of customers who purchase SAE's CD-ROMs had not previously purchased hard copies. To meet the continued demands of its customers while aggressively pursuing additional forums for information distribution, the Electronic Publishing Division grew 29% in 1996 and has a projected growth of 35% in 1997.

To access technical and industry information, more professionals are turning to the convenience and speed of sophisticated technology. As a result, SAE's Electronic Publishing Division continues to develop advanced options, broader product offerings, and more specialized information for its customers.

Publications

SAE publishes and distributes hundreds of books, publications, and papers. Each year more than 20,000 pages of new mobility-related technical material are added. Topics include high-strength steels, computer-aided design, artificial intelligence, aerodynamics, intelligent highway systems, biomechanics, and space operations simulation. Four technical magazines provide the latest engineering developments to 184,000 engineers, business executives, manufacturing professionals, and government officials in 100 countries. Magazines include *Automotive Engineering* and *Aerospace En-*

gineering (published monthly); *Off Highway Engineering* (published quarterly); and *Truck Engineering* (published annually). SAE publishes approximately 2,000 technical papers each year. Other published documents include white papers, surveys, and annual reports. Bibliographic data for most of SAE's publications are available electronically from the Global Mobility Database or on CD-ROM. SAE anticipates that most of its distributed information will be available via the Internet by the end of 1998.

Except for the actual printing, SAE performs all of the publishing, marketing, and distributing of its publications. Marketing strategies include all traditional methods such as direct mail, advertising, and exhibits. SAE also employs cross-marketing techniques to leverage all of its available media (e.g., magazines, catalogs, conferences, workshops) for maximum coverage. To refine its marketing strategies, SAE uses its website data to analyze and identify which publications receive the greatest amount of interest.

Standards Development

The Technical Standards Board (TSB) oversees the overall responsibilities of the standards development operations through the various administrative committees, councils, divisions, and technical committees. TSB is the only group within SAE authorized to develop standards and take responsibility for any requirements associated with consensus activities. SAE has nearly 6,000 standards available on nearly every facet of the mobility industry.

SAE uses a consensus process to develop and maintain its standards. This large-scale activity requires a high level of coordination and management. Approximately 600 cooperative technical committees comprising 15,000 participants write the standards and add approximately 600 new or revised standards each year. TSB promotes and supervises the cooperative

technical committees' activities including SAE's participation in other organizations' technical committees. The board approves and issues reports, standards, and recommended practices developed by the cooperative technical committees.

Although the committees consist of individuals from industry, government, and academia, SAE staff members perform the coordination and administrative functions of the process such as preparing and distributing meeting notices, correspondences, agendas, and minutes; maintaining committee records and rosters; making on-site arrangements for meetings; and counseling committee members and chairpersons on SAE policies, procedures, and practices. In addition, the SAE staff serves as the focal point for information contacts, acts as a clearinghouse for all inquiries, and provides liaison representation with other SAE committees when required.

SAE consensus documents are classified by a letter designation system. For example, J documents indicate ground vehicles (subdivided into

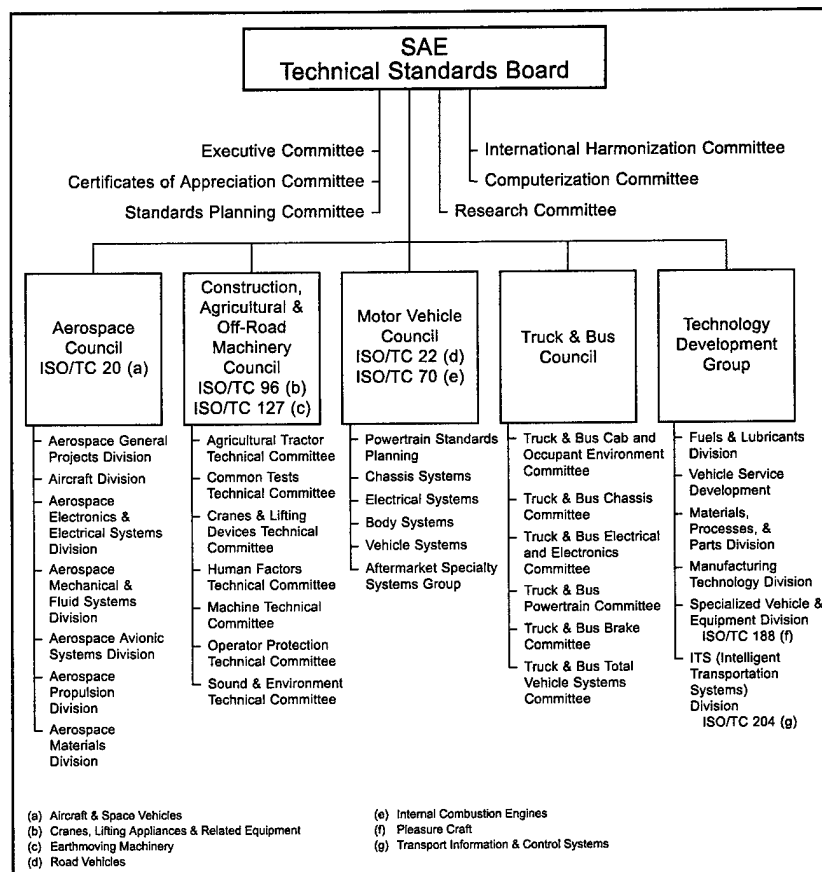


Figure 2-5. Standards Development Councils

information reports, recommended practices, and standards), and A documents indicate aerospace vehicles (subdivided into information reports, recommended practices, standards, and specifications). Typically, consensus documents evolve from information reports to recommended practices to standards and specifications over time. Information reports contain a compilation of engineering reference data and educational material that are useful to the technical community. Recommended practices specify general or lesser-known practices, procedures, and technology as guides for standard engineering practices. Standards specify broadly-accepted engineering practices or specifications for a material, product, process, procedure, or test method. Specifications identify material and process parameters and qualifications which conform to sound, established engineering practices in a specific field.

Figure 2-5 shows the organization of the standards councils and the corresponding divisions and major committees below them. The report approval process works through multiple levels for achieving consensus (Figure 2-6), each following the same consensus procedure. The documents are developed and written by the technical committees, and reviewed by the councils. A ballot approval method is used to achieve consensus. Presently, balloting is done via mail; however, SAE is currently testing alternative methods such as facsimile and e-mail. For a document to be approved for publication, each ballot must have a 50% membership response from the total voting committee members and a 66% approval vote from those that responded. In addition, the committee or council attempts to resolve any dissenting viewpoints prior to approval.

Since the report approval process depends on the contributions of thousands of industry participants, a document can take a long time from development to publication. However, this process is much more efficient than traditional standards development processes which require unanimous consent. SAE has observed a decline in industry participation because of multiple demands on members' time. To meet the demand for new and revised standards, SAE supplements its participants with staff members and consultants.

The standards development operation enables SAE to be one of the largest producers of standards and technical information in the world. SAE is recognized globally as the standards development organization which best meets the needs of the mobility industry.

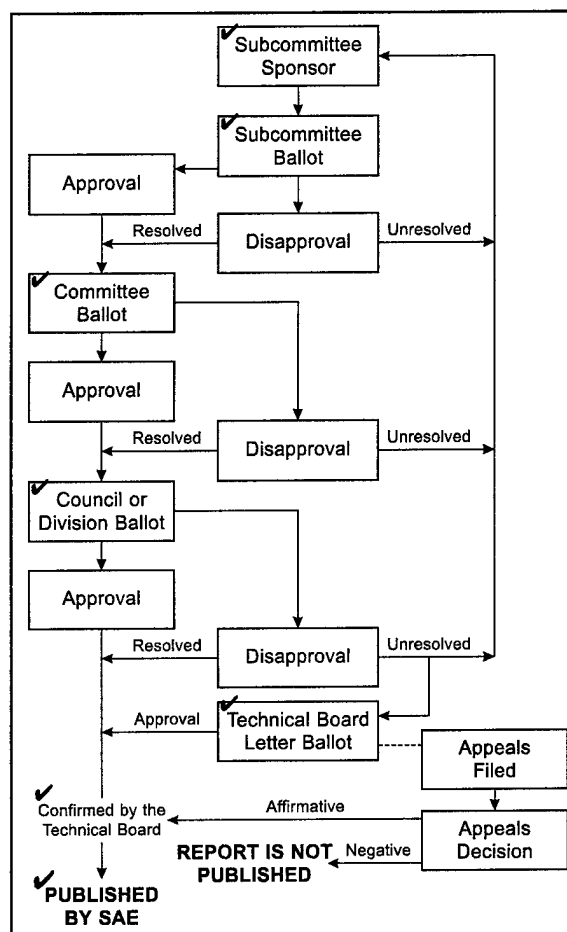


Figure 2-6. Report Approval Process

Technical Information Management System

In late 1993, SAE established a committee to focus on the Society's technical information assets. A decision was made to change the collection, production, and distribution of technical information from a paper distribution system to a computerized database system driven by engineers' needs for quick, on-demand information. With this goal in mind, SAE's core competencies will be maintained through the Technical Information Management System (TIMS). Figure 2-7 depicts the flow of the technical information and positioning of TIMS within the SAE organization. Using ORACLE, SAE is developing the TIMS database interface which will combine the system's major components: the Publishing System, the Document Management System, the TIMS Explorer, and miscellaneous tools and utilities.

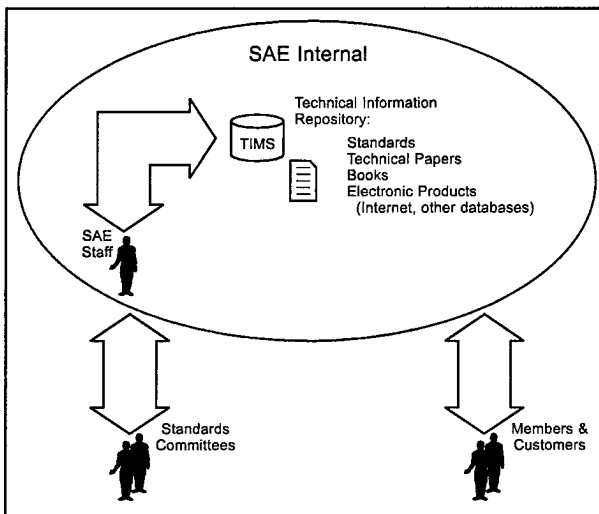


Figure 2-7. Role of TIMS in Technical Information Flow

The Publishing System component is performed using Adobe's FrameMaker + SGML. As a structured word processor, this software allows information to be tagged. For example, by tagging the scope of each standard, it can be identified and extracted from the document's content and reused in other products without being retyped. The Document Management System component is performed by Documentum Corporation's Documentum. As a document management system, this software controls access, manages the numerous revisions, and

provides features for tracking various items such as the check-in and check-out times of individual products. The TIMS Explorer is the desktop user interface which integrates the other components and provides the real functionality of the management system in supporting SAE processes. TIMS will be able to provide more detailed online status reports of the standards development process; more accurate and timely status of ballots and voting participation; integration to the Global Mobility Database for more complete searching; and delivery standards in customer-defined documents (e.g., all standards of a particular committee combined into a single document and provided in electronic or hard copy versions).

To successfully introduce such a large system, SAE developed a process to reduce complications typically encountered during the implementation of complex management systems. In October 1996, SAE began a beta test on TIMS so teams of users within SAE could use the system for daily activities. This roll-out, scheduled for Fall 1997, will address converting the existing documents into the new format, training users, and adding new features as needed. The entire implementation process, including the conversion of 900 J reports, is expected to continue through 1997. Ultimately, TIMS will allow the standards committees to focus on a standard's content and the SAE staff to focus on a standard's format.

Section 3

Information

Test

Engineering Tools

SAE's Standards Development and Research Division has taken a proactive approach to meet its vision of advancing the mobility community and producing a revenue stream for the Technical Standards Board. To facilitate the implementation and use of standards throughout industry, SAE has developed engineering tools to fill a niche in technology not met by industry, government, or academia. Within SAE, these tools are developed and classified under referee materials and engineering aids.

Referee materials help an industry baseline its materials by providing a specific product for which comparisons can be made. These materials, purchased directly from SAE, are applicable to the documents, test procedures, and standards which SAE helped produce. For example, an organization may need to verify that a new brake fluid meets a particular industry standard. The SAE referee material provides a product whose characteristics are known and to which a company's product can be compared. Often times, the known materials are expensive and only sold in bulk by the manufacturers. Instead, SAE sells the materials in useful quantities at a reasonable cost.

Engineering aids are tools to ensure the success of engineering designs throughout the automotive industry. SAE has developed various devices for verifying test results and standards. SAE's most successful tool is the Three-Dimensional H-Point Engineering Aid Support (Figure 3-1) which supports SAE, ISO, and other international standards for describing seated occupant location in vehicles. Key reference points, such as the pivot center of the torso and thigh, are provided for defining and measuring spatial accommodation. SAE is the sole-source provider of the Three-Dimensional H-Point Engineering Aid Support which has received positive responses from its users.

The referee materials and engineering aids represent SAE's only non-publication-related products. Revenue from these products is routed to the Technical Standards Board for supplementing work in other critical mission areas. By developing engi-

neering tools, SAE has expanded its capabilities in meeting its customers' needs.

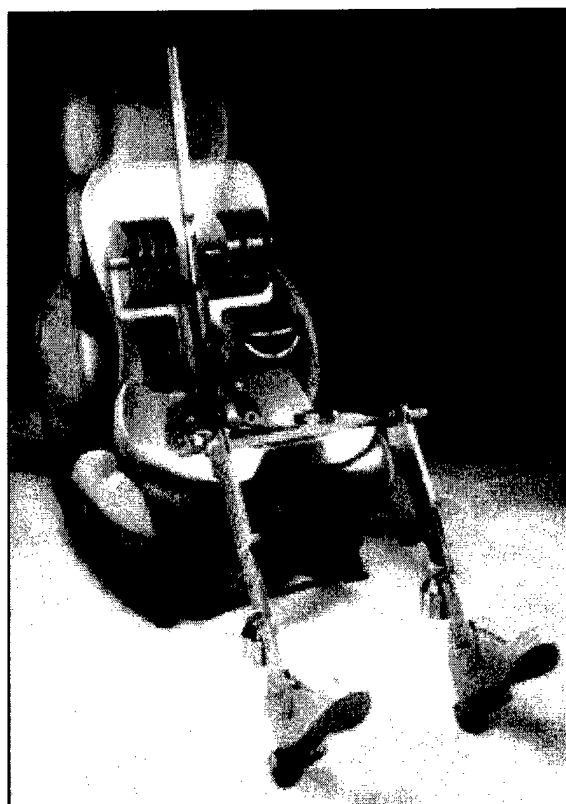


Figure 3-1. Three-Dimensional H-Point Engineering Aid Support

Logistics

International Role in Mobility Engineering

After making the decision to become international in its scope and role, SAE established its first affiliate (SAE Brazil) in 1991. SAE's membership is now available throughout the world with a focus on Europe (Great Britain, Germany), Russia, China, Brazil, India, Japan, Ukraine, Romania, and Korea.

To measure the success of its globalization program, SAE monitors: membership outside North America; percentage of non-North American com-

mittee members; membership retention rate outside North America; number of standards developed; and the health of joint meetings. Operating boards and committees have taken action to implement SAE's globalization program. Currently, more than 2,000 non-North American members participate on SAE committees. International membership has increased over the last several years, and 30% of the hits on SAE's website originate from overseas countries. At this time, all SAE standards and publications are only available in English. In addition, SAE has learned that what works in one country does not necessarily work in another. SAE now customizes its services and information to a specific country based on its culture and economy.

SAE provides the mobility industry input for the American National Standards Institute (the U.S. official member to ISO). Permitted to communicate directly to ISO, SAE advocates U.S. industry participation in the ISO standards development. With its focus currently on cutting costs, U.S. industry's participation in ISO has been limited and relatively ineffective. As a result, a U.S. manufacturer who wanted to sell its products outside North America had to substantially modify those products to meet ISO requirements, causing significant additional costs. SAE is trying to educate U.S. industry on the payback which would result from increased participation in the ISO standards development process.

Management

Cooperative Research Program Marketing

SAE is developing a proactive marketing effort to promote and sell its Cooperative Research Program (CRP) and administrative services. Established in 1990, CRP has steadily increased the number of projects processed and improved the delivery of administrative services. Through this growth period, the market has dictated an even larger demand for cooperative research programs. By capitalizing on SAE's unique administrative services, many programs could produce a successful outcome. However, most outsiders were unfamiliar with SAE's services. In the past, outreach activities to identify markets for SAE services were limited to announcements, newsletters, and advertisements.

The new strategy features assigning a full-time marketing representative to direct proposals and presentations at special interest groups through-

out the mobility industry; increasing the awareness of CRP activities, industry trends, and government regulations; establishing and maintaining industry and government contacts; developing long-term, ongoing, repeat relationships; and actively soliciting funds for assigned research projects. SAE's marketing effort will establish and maintain short and long range sales and marketing plans in line with SAE strategic plans. Existing promotional materials will be updated, and new promotional materials will be developed. A comprehensive database will be established and maintained to incorporate the progress and results of research projects; CRP's administrative activities; active and prospective clients; industry trends; and other metrics needed for reporting program benefits. Additionally, the marketing representative will develop a personal insight to the client base and the overall CRP program process by participating in administrative services such as coordinating meetings; working with project groups to develop scopes; identifying milestones and research projects; providing guidance and support to the committees; and monitoring progress of projects.

The mobility industry offers numerous opportunities for large and small companies to benefit from pre-competitive cooperative research. SAE has already established a proven track record in cooperative research programs. Through its proactive marketing efforts, SAE anticipates addressing and promoting its cooperative research services to effectively meet the needs of industry.

Performance Review Board

As an integral part of the SAE corporate structure, the Performance Review Board (PRB) is responsible for the majority of the DoD's (Army) component interests, although other major activities can involve private sector organizations. PRB reviews test data on product samples and determines if the data, as reported, meets the appropriate standards or specifications. Examples of PRB activities include the Lubricant Review Institute and the Brake Lining Review Institute.

Meeting five times a year, the Lubricant Review Institute reviews lubricant sample test data for the Army. Those samples which have demonstrated their ability to meet the appropriate standard, based on the data presented, are incorporated into an overall qualified products list by the Army. The Brake Lining Review Institute receives test data on

brake lining samples from various business competitors. By using a coding scheme on the samples, the Institute maintains a sample-source privacy. Samples that meet the appropriate standard, based on the data presented, are recommended to the American Trucking Association which sponsors the Institute's activities.

Revenue

SAE operates as a not-for-profit corporation that is tax exempt under Section 501(c)(3) of the Internal Revenue Code. As a technical society, SAE focuses on developing, collecting, and disseminating mobility technology knowledge on a worldwide basis and advancing these fields and their practitioners in a manner which serves humanity. PRI,

affiliated with SAE, is a 501(c)(6) tax-exempt corporation that compiles and reviews performance standards; promotes and administers quality assurance, accreditation and certification programs for the benefit of industry, government, and the general public; and contributes funds, property, and services to non-profit organizations that develop standards for maintaining and improving the quality and performance within the automotive industry. The SAE Foundation, organized as part of SAE, was created for facilitating financial contributions from members and other sources. The Foundation provides an additional source of income, beyond those sources normally available to SAE, for activities in support of SAE. SAE's annual report is available upon request.

Section 4

Problem Area

Logistics

MIL SPEC Conversion to Commercial Standards

Commercial industry has accepted and used many military standards for its procurements. With the Perry initiative, many military specifications are being canceled or converted to commercial standards. SAE is converting 12 selected military specifications into commercial standards with an additional 2,000 military specifications potentially slated for commercial conversion. Since some military specifications are being discontinued, new commercial standards must be developed as replacements. However, problems have arisen in those situations where the new commercial specification does not have the exact requirements as the military specification. For example, the procurement for aircraft aluminum to the industry standard, developed from QQ-A-200, does not meet the aerospace industry's requirements and would have

jeopardized airplane certifications had it not been discovered immediately.

SAE and the Aerospace Industries Association have developed an Early Warning Project Group to try to prevent future problems from occurring related to the differing requirements in the aerospace industry. In addition, the Aerospace Council Task Group is developing conversion guidelines for military specifications. A problem in cross-referencing the commercial specification back to the original specification was also noted. To eliminate this problem, the Aerospace Council Task Group developed a numbering system to cross-reference the commercial specifications. For example, AMS/ QQ-A-200 signifies that it is technically equivalent to QQ-A-200.

Industry support of the efforts to convert the military specifications has been low. Government support has also been low due to the relocation or retirement of technical experts. In addition, costs must be considered for the conversion process, but there seems to be little consideration by industry and government on how these costs will be paid.

Appendix A

Table of Acronyms

Acronym	Definition
APO	Aerospace Program Office
CAESAR CRP	Civilian American & European Surface Anthropometry Resource Cooperative Research Program
FAA	Federal Aviation Administration
GMD	Global Mobility Database
ISO	International Standards Organization
NADCAP	National Aerospace and Defense Contractors Accreditation Program
PRB PRI	Performance Review Board Performance Review Institute
SAE	Society of Automotive Engineers
TIMS TSB	Technical Information Management System Technical Standards Board

Appendix B

BMP Survey Team

Team Member	Activity	Function
Larry Robertson (812) 854-5336	Crane Division Naval Surface Warfare Center Crane, IN	Team Chairman
Cheri Spencer (301) 403-8100	BMP Center of Excellence	Technical Writer
Team 1		
Rick Purcell (301) 403-8100	BMP Center of Excellence College Park, MD	Team Leader
Ron Prater (703) 271-9055	Production Technology, Inc Arlington, VA	
Team 2		
Larry Halbig (317) 306-3838	Hughes Air Warfare Center Indianapolis, IN	Team Leader
Bob Yorke (909) 273-4934	Naval Warfare Assessment Division Corona, CA	

Appendix C

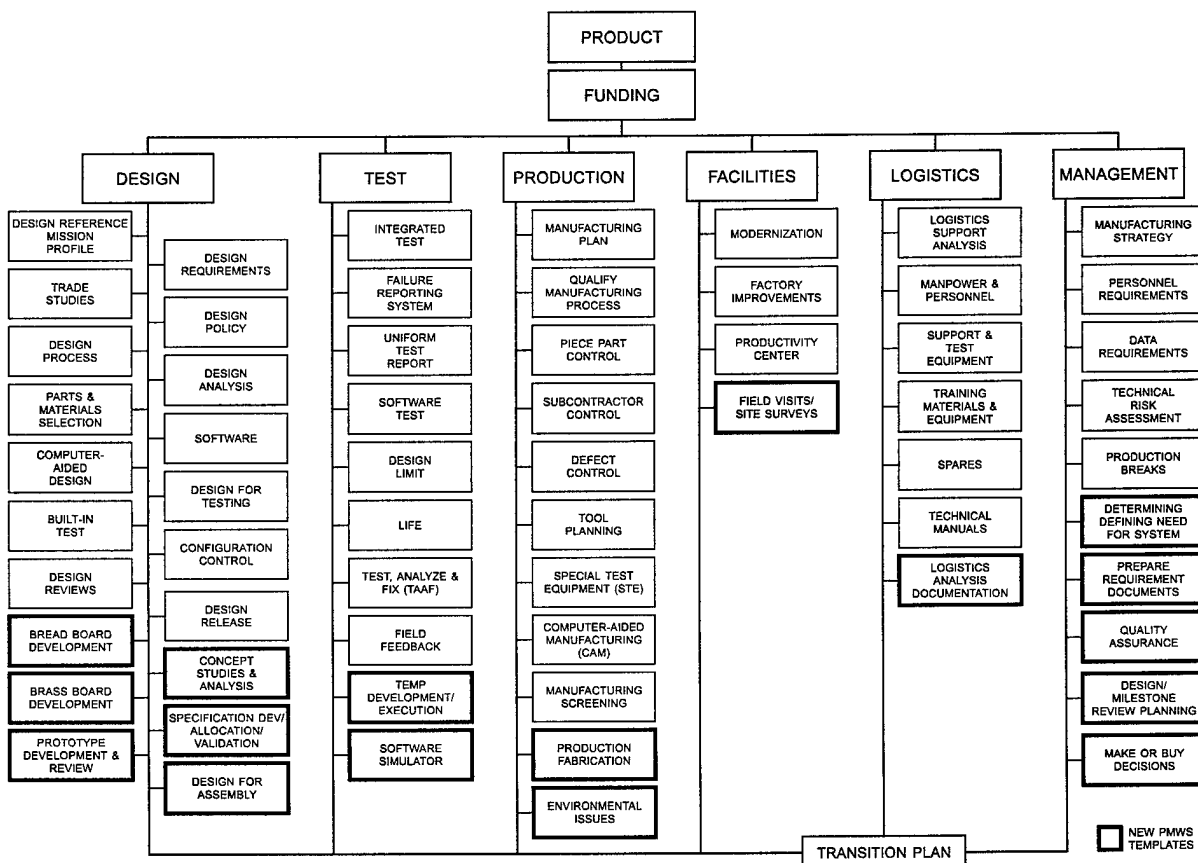
Critical Path Templates and BMP Templates

This survey was structured around and concentrated on the functional areas of design, test, production, facilities, logistics, and management as presented in the Department of Defense 4245.7-M, *Transition from Development to Production* document. This publication defines the proper tools—or templates—that constitute the critical path for a successful material acquisition program. It describes techniques for improving the acquisition

process by addressing it as an *industrial* process that focuses on the product's design, test, and production phases which are interrelated and interdependent disciplines.

The BMP program has continued to build on this knowledge base by developing 17 new templates that complement the existing DOD 4245.7-M templates. These BMP templates address new or emerging technologies and processes.

“CRITICAL PATH TEMPLATES FOR TRANSITION FROM DEVELOPMENT TO PRODUCTION”



Appendix D

BMPnet and the Program Manager's WorkStation

The BMPnet, located at the Best Manufacturing Practices Center of Excellence (BMPCOE) in College Park, Maryland, supports several communication features. These features include the Program Manager's WorkStation (**PMWS**), electronic mail and file transfer capabilities, as well as access to Special Interest Groups (SIGs) for specific topic information and communication. The BMPnet can be accessed through the World Wide Web (at <http://www.bmpcoe.org>), through free software that connects directly over the Internet or through a modem. The PMWS software is also available on CD-ROM.

PMWS provides users with timely acquisition and engineering information through a series of interrelated software environments and knowledge-based packages. The main components of PMWS are KnowHow, SpecRite, the Technical Risk Identification and Mitigation System (TRIMS), and the BMP Database.

KnowHow is an intelligent, automated program that provides rapid access to information through an intelligent search capability. Information currently available in KnowHow handbooks includes Acquisition Streamlining, Non-Development Items, Value Engineering, NAVSO P-6071 (Best Practices Manual), MIL-STD-2167/2168 and the DoD 5000 series documents. KnowHow cuts document search time by 95%, providing critical, user-specific information in under three minutes.

SpecRite is a performance specification generator based on expert knowledge from all uniformed services. This program guides acquisition person-

nel in creating specifications for their requirements, and is structured for the build/approval process. SpecRite's knowledge-based guidance and assistance structure is modular, flexible, and provides output in MIL-STD 961D format in the form of editable WordPerfect® files.

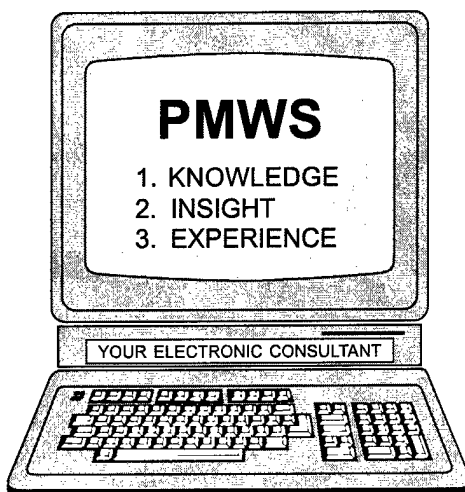
TRIMS, based on DoD 4245.7-M (the transition templates), NAVSO P-6071, and DoD 5000 event-oriented acquisition, helps the user identify and rank a program's high-risk areas. By helping the user conduct a full range of risk assessments through-

out the acquisition process, TRIMS highlights areas where corrective action can be initiated before risks develop into problems. It also helps users track key project documentation from concept through production including goals, responsible personnel, and next action dates for future activities.

The **BMP Database** contains proven best practices from industry, government, and the academic communities. These best practices are in the areas of design, test, production, facilities, management, and logistics. Each practice has been

observed, verified, and documented by a team of government experts during BMP surveys.

Access to the BMPnet through dial-in or on Internet requires a special modem program. This program can be obtained by calling the BMPnet Help Desk at (301) 403-8179 or it can be downloaded from the World Wide Web at <http://www.bmpcoe.org>. To receive a user/e-mail account on the BMPnet, send a request to helpdesk@bmpcoe.org.



Appendix E

Best Manufacturing Practices Satellite Centers

There are currently six Best Manufacturing Practices (BMP) satellite centers that provide representation for and awareness of the BMP program to regional industry, government and academic institutions. The centers also promote the use of BMP with regional Manufacturing Technology Centers. Regional manufacturers can take advantage of the BMP satellite centers to help resolve problems, as the centers host informative, one-day regional workshops that focus on specific technical issues.

Center representatives also conduct BMP lectures at regional colleges and universities; maintain lists of experts who are potential survey team members; provide team member training; identify regional experts for inclusion in the BMPnet SIG e-mail; and train regional personnel in the use of BMP resources such as the BMPnet.

The six BMP satellite centers include:

California

Chris Matzke

BMP Satellite Center Manager
Naval Warfare Assessment Division
Code QA-21, P.O. Box 5000
Corona, CA 91718-5000
(909) 273-4992
FAX: (909) 273-4123
cmatzke@bmpcoe.org

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BMP Satellite Center Manager
257 Cottonwood Drive
Vallejo, CA 94591
(707) 642-4267
FAX: (707) 642-4267
jtamargo@bmpcoe.org

District of Columbia

Margaret Cahill

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U.S. Department of Commerce
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Oak Ridge, TN 37831-8091
(423) 576-5532
FAX: (423) 574-2000
tgraham@bmpcoe.org

Appendix F

Navy Manufacturing Technology Centers of Excellence

The Navy Manufacturing Sciences and Technology Program established the following Centers of Excellence (COEs) to provide focal points for the development and technology transfer of new manufacturing processes and equipment in a cooperative environment with industry, academia, and Navy centers and laboratories. These COEs are consortium-structured for industry, academia, and government involvement in developing and implementing technologies. Each COE has a designated point of contact listed below with the individual COE information.

Best Manufacturing Practices Center of Excellence

The Best Manufacturing Practices Center of Excellence (BMPCOE) provides a national resource to identify and promote exemplary manufacturing and business practices and to disseminate this information to the U.S. Industrial Base. The BMPCOE was established by the Navy's BMP program, Department of Commerce's National Institute of Standards and Technology, and the University of Maryland at College Park, Maryland. The BMPCOE improves the use of existing technology, promotes the introduction of improved technologies, and provides non-competitive means to address common problems, and has become a significant factor in countering foreign competition.

Point of Contact:
Mr. Ernie Renner
Best Manufacturing Practices Center of Excellence
4321 Hartwick Road
Suite 400
College Park, MD 20740
(301) 403-8100
FAX: (301) 403-8180
ernie@bmpcoe.org

Center of Excellence for Composites Manufacturing Technology

The Center of Excellence for Composites Manufacturing Technology (CECMT) provides a national resource for the development and dissemination of composites manufacturing technology to defense contractors and subcontractors. The CECMT is managed by the GreatLakes Composites Consortium and represents a collaborative effort among industry, academia, and government to develop, evaluate, demonstrate, and test composites manufacturing technologies. The technical work is problem-driven to reflect current and future Navy needs in the composites industrial community.

Point of Contact:
Dr. Roger Fountain
Center of Excellence for Composites Manufacturing Technology
103 Trade Zone Drive
Suite 26C
West Columbia, SC 29170
(803) 822-3705
FAX: (803) 822-3730
frglcc@aol.com

Electronics Manufacturing Productivity Facility

The Electronics Manufacturing Productivity Facility (EMPF) identifies, develops, and transfers innovative electronics manufacturing processes to domestic firms in support of the manufacture of affordable military systems. The EMPF operates as a consortium comprised of industry, university, and government participants, led by the American Competitiveness Institute under a CRADA with the Navy.

Point of Contact:
Mr. Alan Criswell
Electronics Manufacturing Productivity Facility
Plymouth Executive Campus
Bldg 630, Suite 100
630 West Germantown Pike
Plymouth Meeting, PA 19462
(610) 832-8800
FAX: (610) 832-8810
<http://www.engriupui.edu/empf/>

National Center for Excellence in Metalworking Technology

The National Center for Excellence in Metalworking Technology (NCEMT) provides a national center for the development, dissemination, and implementation of advanced technologies for metalworking products and processes. The NCEMT, operated by Concurrent Technologies Corporation, helps the Navy and defense contractors improve

manufacturing productivity and part reliability through development, deployment, training, and education for advanced metalworking technologies.

Point of Contact:

Mr. Richard Henry

National Center for Excellence in Metalworking
Technology

1450 Scalp Avenue

Johnstown, PA 15904-3374

(814) 269-2532

FAX: (814) 269-2799

henry@ctc.com

Navy Joining Center

The Navy Joining Center (NJC) is operated by the Edison Welding Institute and provides a national resource for the development of materials joining expertise and the deployment of emerging manufacturing technologies to Navy contractors, subcontractors, and other activities. The NJC works with the Navy to determine and evaluate joining technology requirements and conduct technology development and deployment projects to address these issues.

Point of Contact:

Mr. David P. Edmonds

Navy Joining Center

1100 Kinnear Road

Columbus, OH 43212-1161

(614) 487-5825

FAX: (614) 486-9528

dave_edmonds@ewi.org

Energetics Manufacturing Technology Center

The Energetics Manufacturing Technology Center (EMTC) addresses unique manufacturing processes and problems of the energetics industrial base to ensure the availability of affordable, quality energetics. The focus of the EMTC is on process technology with a goal of reducing manufacturing costs while improving product quality and reliability. The COE also maintains a goal of development and implementation of environmentally benign energetics manufacturing processes.

Point of Contact:

Mr. John Brough

Energetics Manufacturing Technology Center

Indian Head Division

Naval Surface Warfare Center

Indian Head, MD 20640-5035

(301) 743-4417

DSN: 354-4417

FAX: (301) 743-4187

mt@command.nosih.sea06.navy.mil

Manufacturing Science and Advanced Materials Processing Institute

The Manufacturing Science and Advanced Materials Processing Institute (MS&I) is comprised of three centers including the National Center for Advanced Drivetrain Technologies (NCADT), The Surface Engineering Manufacturing Technology Center (SEMTC), and the Laser Applications Research Center (LaserARC). These centers are located at The Pennsylvania State University's Applied Research Laboratory. Each center is highlighted below.

Point of Contact for MS&I:

Mr. Henry Watson

Manufacturing Science and Advanced Materials

Processing Institute

ARL Penn State

P.O. Box 30

State College, PA 16804-0030

(814) 865-6345

FAX: (814) 863-1183

hew2@psu.edu

- **National Center for Advanced Drivetrain Technologies**

The NCADT supports DoD by strengthening, revitalizing, and enhancing the technological capabilities of the U.S. gear and transmission industry. It provides a site for neutral testing to verify accuracy and performance of gear and transmission components.

Point of Contact for NCADT:

Dr. Suren Rao

NCADT/Drivetrain Center

ARL Penn State

P.O. Box 30

State College, PA 16804-0030

(814) 865-3537

FAX: (814) 863-6185

http://www.arl.psu.edu/drivetrain_center.html/

- **Surface Engineering Manufacturing Technology Center**

The SEMTC enables technology development in surface engineering—the systematic and rational modification of material surfaces to provide desirable material characteristics and performance. This can be implemented for complex optical, electrical, chemical, and mechanical functions or products that affect the cost, operation, maintainability, and reliability of weapon systems.

Point of Contact for SEMTC:
Dr. Maurice F. Amateau
SEMTC/Surface Engineering Center
P.O. Box 30
State College, PA 16804-0030
(814) 863-4214
FAX: (814) 863-0006
http://www/arl.psu.edu/divisions/arl_org.html

- **Laser Applications Research Center**

The LaserARC is established to expand the technical capabilities of DOD by providing access to high-power industrial lasers for advanced material processing applications. LaserARC offers basic and applied research in laser-material interaction, process development, sensor technologies, and corresponding demonstrations of developed applications.

Point of Contact for LaserARC:
Mr. Paul Denney
Laser Center
ARL Penn State
P.O. Box 30
State College, PA 16804-0030
(814) 865-2934
FAX: (814) 863-1183
http://www/arl.psu.edu/divisions/arl_org.html

Gulf Coast Region Maritime Technology Center

The Gulf Coast Region Maritime Technology Center (GCRMTC) is located at the University of New Orleans and will focus primarily on product developments in support of the U.S. shipbuilding industry. A sister site at Lamar University in Orange, Texas will focus on process improvements.

Point of Contact:
Dr. John Crisp
Gulf Coast Region Maritime Technology Center
University of New Orleans
Room N-212
New Orleans, LA 70148
(504) 286-3871
FAX: (504) 286-3898

Appendix G

Completed Surveys

As of this publication, 89 surveys have been conducted by BMP at the companies listed below. Copies of older survey reports may be obtained through DTIC or by accessing the BMPnet. Requests for copies of recent survey reports or inquiries regarding the BMPnet may be directed to:

Best Manufacturing Practices Program
4321 Hartwick Rd., Suite 400
College Park, MD 20740
Attn: Mr. Ernie Renner, Director
Telephone: 1-800-789-4267
FAX: (301) 403-8180
ernie@bmpcoe.org

1985	Litton Guidance & Control Systems Division - Woodland Hills, CA
1986	Honeywell, Incorporated Undersea Systems Division - Hopkins, MN (Alliant TechSystems, Inc.) Texas Instruments Defense Systems & Electronics Group - Lewisville, TX General Dynamics Pomona Division - Pomona, CA Harris Corporation Government Support Systems Division - Syosset, NY IBM Corporation Federal Systems Division - Owego, NY Control Data Corporation Government Systems Division - Minneapolis, MN
1987	Hughes Aircraft Company Radar Systems Group - Los Angeles, CA ITT Avionics Division - Clifton, NJ Rockwell International Corporation Collins Defense Communications - Cedar Rapids, IA UNISYS Computer Systems Division - St. Paul, MN (Paramax)
1988	Motorola Government Electronics Group - Scottsdale, AZ General Dynamics Fort Worth Division - Fort Worth, TX Texas Instruments Defense Systems & Electronics Group - Dallas, TX Hughes Aircraft Company Missile Systems Group - Tucson, AZ Bell Helicopter Textron, Inc. - Fort Worth, TX Litton Data Systems Division - Van Nuys, CA GTE C ³ Systems Sector - Needham Heights, MA
1989	McDonnell-Douglas Corporation McDonnell Aircraft Company - St. Louis, MO Northrop Corporation Aircraft Division - Hawthorne, CA Litton Applied Technology Division - San Jose, CA Litton Amecom Division - College Park, MD Standard Industries - LaMirada, CA Engineered Circuit Research, Incorporated - Milpitas, CA Teledyne Industries Incorporated Electronics Division - Newbury Park, CA Lockheed Aeronautical Systems Company - Marietta, GA Lockheed Corporation Missile Systems Division - Sunnyvale, CA Westinghouse Electronic Systems Group - Baltimore, MD General Electric Naval & Drive Turbine Systems - Fitchburg, MA Rockwell International Corporation Autonetics Electronics Systems - Anaheim, CA TRICOR Systems, Incorporated - Elgin, IL
1990	Hughes Aircraft Company Ground Systems Group - Fullerton, CA TRW Military Electronics and Avionics Division - San Diego, CA MechTronics of Arizona, Inc. - Phoenix, AZ Boeing Aerospace & Electronics - Corinth, TX Technology Matrix Consortium - Traverse City, MI Textron Lycoming - Stratford, CT

1991	<i>Resurvey of Litton Guidance & Control Systems Division</i> - Woodland Hills, CA Norden Systems, Inc. - Norwalk, CT Naval Avionics Center - Indianapolis, IN United Electric Controls - Watertown, MA Kurt Manufacturing Co. - Minneapolis, MN MagneTek Defense Systems - Anaheim, CA Raytheon Missile Systems Division - Andover, MA AT&T Federal Systems Advanced Technologies and AT&T Bell Laboratories - Greensboro, NC and Whippany, NJ <i>Resurvey of Texas Instruments Defense Systems & Electronics Group</i> - Lewisville, TX
1992	Tandem Computers - Cupertino, CA Charleston Naval Shipyard - Charleston, SC Conax Florida Corporation - St. Petersburg, FL Texas Instruments Semiconductor Group Military Products - Midland, TX Hewlett-Packard Palo Alto Fabrication Center - Palo Alto, CA Watervliet U.S. Army Arsenal - Watervliet, NY Digital Equipment Company Enclosures Business - Westfield, MA and Maynard, MA Computing Devices International - Minneapolis, MN <i>(Resurvey of Control Data Corporation Government Systems Division)</i> Naval Aviation Depot Naval Air Station - Pensacola, FL
1993	NASA Marshall Space Flight Center - Huntsville, AL Naval Aviation Depot Naval Air Station - Jacksonville, FL Department of Energy Oak Ridge Facilities (Operated by Martin Marietta Energy Systems, Inc.) - Oak Ridge, TN McDonnell Douglas Aerospace - Huntington Beach, CA Crane Division Naval Surface Warfare Center - Crane, IN and Louisville, KY Philadelphia Naval Shipyard - Philadelphia, PA R. J. Reynolds Tobacco Company - Winston-Salem, NC Crystal Gateway Marriott Hotel - Arlington, VA Hamilton Standard Electronic Manufacturing Facility - Farmington, CT Alpha Industries, Inc. - Methuen, MA
1994	Harris Semiconductor - Melbourne, FL United Defense, L.P. Ground Systems Division - San Jose, CA Naval Undersea Warfare Center Division Keyport - Keyport, WA Mason & Hanger - Silas Mason Co., Inc. - Middletown, IA Kaiser Electronics - San Jose, CA U.S. Army Combat Systems Test Activity - Aberdeen, MD Stafford County Public Schools - Stafford County, VA
1995	Sandia National Laboratories - Albuquerque, NM Rockwell Defense Electronics Collins Avionics & Communications Division - Cedar Rapids, IA <i>(Resurvey of Rockwell International Corporation Collins Defense Communications)</i> Lockheed Martin Electronics & Missiles - Orlando, FL McDonnell Douglas Aerospace (St. Louis) - St. Louis, MO <i>(Resurvey of McDonnell-Douglas Corporation McDonnell Aircraft Company)</i> Dayton Parts, Inc. - Harrisburg, PA Wainwright Industries - St. Peters, MO Lockheed Martin Tactical Aircraft Systems - Fort Worth, TX <i>(Resurvey of General Dynamics Fort Worth Division)</i> Lockheed Martin Government Electronic Systems - Moorestown, NJ Sacramento Manufacturing and Services Division - Sacramento, CA JLG Industries, Inc. - McConnellsburg, PA
1996	City of Chattanooga - Chattanooga, TN Mason & Hanger Corporation - Pantex Plant - Amarillo, TX Nascote Industries, Inc. - Nashville, IL Weirton Steel Corporation - Weirton, WV NASA Kennedy Space Center - Cape Canaveral, FL

1997

Headquarters, U.S. Army Industrial Operations Command - Rock Island, IL
SAE International and Performance Review Institute - Warrendale, PA

INTERNET DOCUMENT INFORMATION FORM

A . Report Title: Best Manufacturing Practices: Report of Survey
Conducted at SAE International and Performance Review Institute,
Warrendale, PA

B. DATE Report Downloaded From the Internet: 01/14/02

**C. Report's Point of Contact: (Name, Organization, Address, Office
Symbol, & Ph #):** Best Manufacturing Practices
Center of Excellence
College Park, MD

D. Currently Applicable Classification Level: Unclassified

E. Distribution Statement A: Approved for Public Release

F. The foregoing information was compiled and provided by:
DTIC-OCA, Initials: __VM__ Preparation Date 01/14/02

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